Abstracts

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Evolution of Israeli forestry from Even-Aged Pure Pine Plantations to Uneven-Aged Sustainable Mixed Forests

Part A: A Review of the Various Approaches to Forest Policy and Management in Israel During the Last Hundred Years

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The planted forests in Israel are at present multifunctional, and designated primarily for provision of ecological services. Afforestation in Israel, which was begun 100 years ago by Keren Kayemeth LeIsrael (KKL) the Israeli Forest Service, was based on the "classical" forestry approach and was characterized in its early days by dense pine plantations dominated by Aleppo pine (*Pinus halepensis*). Early criticism of the KKL forestry policy by environmentalists and ecologists included recommendations to reduce planting density and to increase species diversity, had already begun in the late 1930s. A massive dieback of 40-year-old planted Aleppo pine stands, attributed mainly to an outbreak of the Israeli pine bast scale (*Matsucoccus josephi*), in the early 1970s led to the use of other species of pine, mainly *Pinus brutia*, instead of Aleppo pine (Figure 1). Toward the late 1980s the use of native broadleaf species in forest plantations was dramatically increased, and much heavier thinning was applied in many young, dense stands. Broadleaf seedlings were planted in mixed forests, either randomly between the conifers (cover photo) or, alternatively, in separate patches of varied sizes to create a complex mosaic-like landscape pattern (photo, page 9). Only in 1990 were the changes – that had been gradually implemented in practice since the early 1970s – formally approved, as the KKL Forest Department revised its forest policy (Figure 1; Table 1). The new policy aimed to create mixed, multi-layered, well spaced forests with higher tolerance and better resilience to climate-change impacts such as drought, fire, and insect infestation. Since then, modifications of this policy have been made from time to time, to strengthen sustainability of the forest by increasing its structural and age diversity.

In 1995, the National Master Plan No. 22: Forests and Afforestation was approved by the Israeli government (KKL, 1995). The plan is unique, in that it defines six different forest formations, and thereby explicitly promotes biodiversity. The plan designates only 42% of the forest area in Israel for coniferous forests; the rest is designated for various native broadleaf forests and other woodland formations.

In 2007, the KKL Board adopted a sustainable forest development policy. This policy emphasized the variety of ecological services that the Israeli forests should provide to the public and to future generations, and it set the goal of creating a second generation of uneven-aged mixed forests, prioritizing the use of native species and natural processes.

In 2012, KKL published the current forest management plan – 'Policy and Guidelines for Forest Planning and Management in Israel' – which recommended increasing the complexity and patchiness of the forest structure.

Development During 1985–2014 of Aleppo Pine (*Pinus halepensis* Mil.) Trees from Several Seed Sources Planted in Five Different Seed Orchards: A Survey

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A survey was conducted in five plots (Table 2) planted with Aleppo pine originated from plus-trees seed collections in three Aleppo pine forests in Greece, and several relict natural Aleppo pine populations and planted forests in Israel (F_1 *generation*). The plots were planted along the rainfall gradient within the country, from Galilee (Carmiel) in the north down to the northern edge of the Negev Desert (Yatir) in the south. These plots were intended to become seed orchards after heavy selection-thinning.

Survey results (Table 4) revealed no significant differences in growth in height and diameter among trees originated from the various seed sources in Greece and Israel. Furthermore, the survey revealed a significant relationship between growth in height and diameter, on the one hand, and the plots' average annual rainfall, on the other hand (Figs 1 & 2). The increase in average annual rainfall from 250 to 400 mm had the strongest influence; any further increase was less influential. Furthermore, most of the trees in the different plots, which are F_1 generation, present crown architecture of fine and evenly distributed branching, barring onlya few cones, similar to the phenotypes of the original seed trees (Table 6).

An additional provenance trial was established, intended to analyze the growth of F_2 generation trees from the seed orchards and compare it with that of those grown from seeds collected freely in various forests. The results (Table 7) revealed the superior growth of the F_2 generation from the seed orchards.

Effects of Changes in Land Use from Virgin Terrain to Planted Forest on Soil Structure and Hydraulic Properties under Various Climatic Conditions in Israel

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A large area of virgin land in Israel was converted to man-made forest, starting in the middle of the 20th century. This change in land use, from virgin land to forest, has had significant effects on environmental and ecological aspects, which were extensively studied. However,

the effects of this change in land use on soil structure and hydraulic conductivity were much less studied. The objectives of the present study were: (1) to investigate the effects of these land-use changes on soil structure and saturated hydraulic conductivity (K_s) under various climatic conditions in the south of Israel; and (2) to study the mechanisms responsible for these effects. Samples of disturbed soil were taken from within a forest and from virgin land adjacent to the forest in three different regions: (1) Be'er Sheva Forest (referred to as the Be'er Sheva Region); (2) Yatir Forest (referred to as the Yatir Region); and Malachim Forest (referred to as the Malachim Region). The long-term average annual rainfall in these regions is 170, 283, and 360 mm, respectively. Organic matter contents, electrical conductivity (EC) and Na adsorption ratio (SAR) values (Table 1), stability of aggregates against slaking, swelling and dispersion forces, and K_s were measured in the various soil samples. In some regions the changes in land use from virgin land to forest increased the aggregate stability, i.e. decreased slaking and dispersion levels (Fig. 3; Table 2, respectively) of the soil samples, and, consequently, decreased their K_s values (Fig. 1). These effects were influenced by the climatic conditions, especially the long-term average annual rainfall. In the Be'er Sheva and Yatir regions, with average annual rainfall of 190 and 283 mm, respectively, the change of land use increased the organic matter content in the forest soil to 1.4 and 3.1%, respectively (Fig. 4) and, consequently, enhanced the K_s values of these soils (Fig. 1). In contrast, in the Malachim region, with average annual rainfall of 360 mm, the organic matter content of 5.5% in the virgin soil was probably high enough to prevent intensive breakdown of the soil structure, similarly to the condition in the forest soil with 8.1% organic matter content. As a result, the K_s values of the virgin and forest soils in the Malachim region were similar (Fig. 1).

Utilization of Logs and Residue from Plantation Management Activities in Israel

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This report documents the results of a USDA Forest Service technical assistance mission to Israel in July 2012, whose purpose was to investigate and offer suggestions regarding: improvement of utilization of forest thinning; retention of forest industry processing capacity; and reduction of costs of forest management activities in Keren Kayemeth LeIsrael-Jewish National Fund (KKL-JNF) plantations.

The primary log or round wood processing system in Israel appears to comprise use of a chainsaw to delimb and buck logs, and of firewood splitters. Estimates vary, but it appears that at least 40%, and perhaps up to 80% of the roundwood removed from KKL-JNF forests goes into the firewood market.

The majority of round wood sold for sawlogs by KKL-JNF contractors is shipped to sawmills in Hebron (West Bank) to make pallet lumber and pallets. A very small volume of sawlogs, perhaps less than 5% of the roundwood removed, goes to sawmills located in Israel proper, for a wide variety of products.

Markets for ground slash are not nearly as well developed as those for firewood and sawlogs. KKL-JNF staff estimated that only 10% of the ground slash from KKL-JNF projects is actually utilized — approximately 5,000 tonnes in total.

A decision-support tool is provided in the appendixes to this report, to help to examine and compare the business cases for products made from KKL-JNF ground wood or wood chips, needles or leaves, bark, roundwood (other than sawlogs), and sawlogs. A total of 35 product categories were identified that can **theoretically** be produced from KKL-JNF thinnings and other treatments. Twelve of these are already being produced or explored, and 13 are considered to have sufficient potential to justify further investigation.

Security Forests in Israel in the 1950s – from Confrontation to Civil/ Military Cooperation

Yoram Fried and **Gideon Biger**

At the end of Israel's War of Independence (1947–1949) the Israel Defense Forces (IDF) found themselves with the requirement to defend a long, narrow country, confronted by enemies along its entire land border, with no natural barriers. Forests were considered by the IDF as a barrier that could help to prevent an enemy advance and also help to conceal the IDF forces. The concept of 'security forests' was taken very seriously by the IDF, which acted vigorously, both through its own efforts and with the help of the civilian afforestation bodies, to promote this perception.

In the first few years after the war the IDF had operated a Vegetation Unit whose role was to establish new tree plantations and to plant the resulting trees in areas designated for security forests. Because of budgetary difficulties the unit's work was shut down in 1953, and all its activities were transferred to the civilian afforestation bodies, mainly the Jewish National Fund (KKL).

Unlike the confrontations that accompanied the relationship between the IDF and civilian organizations in the early 1950s, after the dissolution of the Vegetation Unit the IDF and the civilian organizations began working together, knowing that cooperation would benefit them both. The IDF gained the security forests they needed and the KKL gained assets in the form of land dedicated to its use, money from the sale of wood products, and prestige among potential donors.

Evaluation of the Survival, and Height and Diameter Growth Rates of Black Pine (*Pinus nigra*) from Different Countries of Origin and Seed Sources in Bar'am Forest in the Upper Galilee Mountains in Israel

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The collapse of planted Aleppo pine stands at altitudes above 600 m a.s.l., because of the snow storms that occurred in Israel in 1992, stimulated evaluation of other species, such as cedars and black pine, which could withstand the weight of snow and ice, to replace Aleppo pine at high elevations. Black pine from nine seed origins (three from Greece, three from Italy, two from Turkey and one from the former Yugoslavia) were planted in 1993 in Bar'am Forest in Galilee (elevation, 675 m a.s.l; annual precipitation, 750 mm). Comparison of the survival, and height and diameter growth rates, of 21-year-old black pine from the various seed origins showed that the seeds originating from Greece and Italy performed better than the others with respect to all three parameters, but the differences were not significant. Our conclusion is that black pine can be successfully planted instead of Aleppo pine at elevations above 600 m in Galilee, in chalky-gray rendzina soils and, presumably, also in low-lime-content soils such as brown rendzina and terra rossa. Cedars can be successfully planted for the same purpose but only on low-lime-content soils.